

Nurses knowledge in Transfusion Medicine in a Portuguese university hospital: the impact of an education

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Introduction

Although most of the errors that occur in transfusion medicine do not cause severe consequences for the patient, such events are not rare and most of the fatal reactions are attributed to human error¹. The majority of the errors occur in clinical wards², including bedside use of the wrong blood units and misidentification of the patient or the sample. Nurses play a very important role in these activities, and more than half of the steps in the transfusion chain are dependent on the nurse's awareness and skills³.

Sufficient knowledge is essential for safe practice. In fact, the Council of Europe recommends that "all nurses should receive training in blood transfusion". Furthermore, the development of quality assurance programmes in health services has been a major concern of both the Council of Europe and the World Health Organization (WHO)⁴. In transfusion medicine, this assurance includes the creation of a hospital transfusion committee to define common transfusion policies, develop standardised procedures and improve communication channels between the different health professionals.

The São João Hospital Center is the largest hospital in northern Portugal, with a high degree of differentiation between services. A total of 2,047 nurses work in complex areas such as cardio-thoracic surgery, haematology, orthopaedic surgery, intensive care units, neonatology and emergency. In recent years, its Transfusion Medicine and Blood Bank Department (TMBBD) has been able to respond and ensure the Hospital's self-sufficiency, collecting around 25,000 blood donations per year and transfusing around 50,000 blood components or derivatives per year.

In order to promote appropriate practice, several strategies to improve blood transfusions were implemented. In March 2012, the Hospital created a Transfusion Committee formed by a multi-disciplinary team, including doctors, nurses, pharmaceuticals, IT technicians and management experts, and launched a Hospital Transfusion Manual based on national and international guidelines to support, guide and educate the clinical staff in each step of the transfusion chain.

In 2013, an education programme was developed and implemented for all nurses addressing safe transfusion practices, in close collaboration with the hospital education department and the support of the Nursing Supervisor and the Director of Nursing.

Studies describing health workers' awareness in transfusion medicine almost always report insufficient knowledge^{5,6}. The aim of this study was to evaluate the knowledge of the nurses of the São João Hospital about blood transfusion, and assess the impact of the education programme in hospital practice. To date, this is the first study to document the current state of knowledge on blood transfusion of health care professionals in a Portuguese university hospital.

Materials and methods

The São João Hospital Center is a university hospital and a tertiary care centre with 1,105 beds. Around 4,800 patients are transfused annually and a median of 50,000 components have been transfused [including red blood cells (RBCs), plasma and platelets] in the last year. The nursing staff is composed of 2,047 nurses who are distributed between different units and departments.

The Transfusion Medicine and Blood Bank Department (TMBBD) has a formal quality assurance system. It is certified by the NP EN ISO 9001:2008 and laboratorial tests are accredited by the NP EN ISO/IEC 17025.

A mandatory postgraduate education programme for all nurses was designed by the Transfusion Committee in partnership with the Hospital Education Department.

This education programme consisted of:

- a 1.5-hour talk covering major issues related to safe blood transfusion;
- a video showing transfusion medicine activities performed at the TMBBD;
- information about access to the hospital intranet where a hospital transfusion manual is available along with the blood transfusion policy and hospital protocols;
- a pocket sized leaflet containing important "take-home messages" focusing on the safety aspects of blood transfusion;
- a certificate of attendance.

A total of 79 2-hour symposiums were organised over a 5-month period.

Two members (one doctor and one nurse) of the TMBBD were responsible for each educational session and addressed 5 main topics regarding the transfusion process:

- 1) risks and benefits of blood transfusion and patient preparation, e.g. the importance of a well-written medical order, making adequate pre-transfusion information available to the patient and the informed consent procedure;
- 2) pre-transfusion samples, e.g. the importance of a correct patient and sample identification procedure;
- 3) blood distribution and storage, e.g. the importance of the correct handling of the different blood components;
- 4) blood therapy, e.g. the importance of correct patient identification, the use of warmers and filters, the drugs or intravenous solutions administration allowed and rates of administration;
- 5) patient monitoring and adverse reactions, e.g. observation of the patient, especially for the first 15 minutes;
- 6) the maximum time to complete the transfusion and identification of symptoms and signs of an adverse reaction and the action to be taken should this occur.

In order to access the knowledge of the nurses taking part in the symposium, all participants filled in an anonymous pre-training assessment questionnaire. The questionnaire was made up of 6 multiple-choice questions (requiring a single correct answer) focusing on the main issues concerning safe blood transfusion (total score 6 points). All the questionnaires were collected before the start of each educational session. After each session, a post-training assessment questionnaire was distributed to the participants with the same 6 questions and the scoring method was described. Only those questionnaires that had been completely filled out were recorded.

Each symposium ended with an open discussion of all kinds of questions, from problems of daily practice to more theoretical aspects of transfusion.

In order to measure the impact of the education programme in hospital practice, an internal evaluation of non-conformity "WMQual" was reported; the WMQual is a database quality system which contains errors and near misses, all of which occur in both laboratory and clinical environment, identified by clinical and nurses at any point of transfusion chain. We examined the number and location of the errors and near misses, and compared data regarding the 12 months before and the 12 months after the education programme took place.

Data underwent statistical analysis to determine the significance of the training sessions; $p < 0.05$ was considered statistically significant (Fisher's test).

Results

Study population

A total of 2,021 nurses (96.4% of all the Hospital nurses) of the São João Hospital Center took part in the educational programme. Table I shows their characteristics: 1,635 (80.9%) female and 386 (19.1%) male; mean age 38 years old; mean work experience 13 years (range 1-40).

An analysis of distribution according to department showed 24.2% worked in medical units, 20.8% in surgical units, 20.5% in intensive care, 9.7% in the emergency room, 9.1% in the operating room, 8.6% in the outpatient clinic, and the remainder in more specialised fields such as radiology, pain units and others.

Evaluation of knowledge about blood transfusion

Not all nurses completed the questionnaires. We obtained a total of 1,695 (83.9%) and 1,773 (87.7%) completely answered questionnaires in the pre-training and post-training collections, respectively.

The overall mean score in the pre-training assessment was 4.8 points, with an individual range between 0 and 6 (median: 5). The mean score in the post-training questionnaire was 5.8 points, ranging from 3 to 6 (median: 6).

Table I - Characteristics of nursing staff taking part in the education programme.

	Total	%
<i>Sex</i>		
Male	386	19.1
Female	1,635	80.9
<i>Age (years)</i>		
<25	2	0.1
25-30	437	21.6
31-40	924	45.7
>40	658	32.6
<i>Years of experience</i>		
<1	9	0.5
1-10	904	44.7
10-20	760	37.6
>2	348	17.2
<i>Distribution by department</i>		
Medical	488	24.2
Surgical	421	20.8
Intensive Care	415	20.5
Emergency room	197	9.7
Operating room	183	9.1
Outpatient clinic	174	8.6
Others	143	7.1
Total	2,021	100

The number of participants scoring the maximum points (6) was 33.4% in the pre- and 90.2%, on the post-assessment questionnaires, respectively.

The number of nurses who gave incorrect answers to all of the questions was 0.5% in the pre-assessment questionnaire. Table II shows the results for each question; there were statistically significant differences between the results of all questions in the pre- and post-assessment collections, respectively ($p < 0.05$ by Fisher's test).

Impact of the training sessions

Concerning the impact of the number of events reported to the haemovigilance system, there were a total number of 13 in the 12 months before the beginning of the education sessions and 2 in the 12 months after (a reduction of 84.6% reduction) (Table III), that can be directly explained for by the education programme, since no other transfusion policies had been implemented during this period.

Discussion

Although knowledge does not always reflects best practice, an adequate education in transfusion medicine helps to promote patient's safety and reduce blood transfusion errors⁴. In this study, we aimed to assess the basic knowledge of all hospital nurses about transfusion medicine, and educate and then assess the effectiveness of our training sessions in both theory and practice.

Analysis of the results shows that nurses from our hospital have a good knowledge of blood transfusion, with 97.4% of the nurses obtaining $\geq 50\%$ correct answers on the pre-assessment questionnaire. Compared to other similar studies, the mean knowledge of our nurses in the pre-assessment questionnaire is clearly superior⁵⁻⁷. These good results could partially be explained by the availability of the transfusion manual that had been uploaded onto the hospital website 8 months before the education sessions started.

When each of the questions is examined separately, those related to blood product storage had some of the highest percentage of errors. Other studies had also shown that knowledge of storage and shelf life of the blood components had been an area of poor nurses' knowledge⁵⁻⁷, and this is also reflected in the majority of errors reported. This may have implications for the quality of blood products and for stock management.

Over half of our nurses were not aware that ABO compatibility is desirable but not a requirement in platelet transfusion. This could show a lack of knowledge, but could also reflect the fact that nurses are indeed aware that ABO compatibility plays an important role in blood transfusion.

There was a significant difference in all questions when comparing the pre-assessment questionnaire answers with those of the post-assessment collection, showing the importance of these refresher training

Table II - Number of correct questions in both pre- and post-assessment questionnaires.

Questions	Pre-training assessment (n=1,695)	Post-training assessment (n=1,773)	p-value
	Correct answer	Correct answer	
1) Types of transfusion requests	1,595 (94%)	1,763 (99%)	<0.001
2) Storage of red cells	1,064 (63%)	1,734 (98%)	<0.001
3) Storage of platelets	1,211 (71%)	1,698 (96%)	<0.001
4) ABO compatibility	835 (49%)	1,680 (95%)	<0.001
5) Administration of blood transfusion and other solutions	1,553 (92%)	1,769 (99%)	<0.001
6) Action if the component is not transfused	1,640 (97%)	1,764 (99%)	<0.001

Table III - Data from the haemovigilance system during the 12 months before and after the training sessions.

Event	Before		After	
	N.	Location	N.	Location
Mislabelling of blood request	1	Ward	0	-
Mislabelling of blood tube	2			
Wrong handling of RBC	5	Ward	2	Ward
Wrong storage of RBC	4	Ward	0	-
Administration in wrong patient	1	Operating room	0	-
Total	13		2	

RBC: red blood cells.

sessions and confirming the efficacy of this training programme.

Conclusions

The ultimate value of an education update is to reduce the number of errors in transfusion medicine. In our study, we saw a decrease and even the elimination of most types of errors, especially those related to patient or sample misidentification, which is essential for safe and quality transfusion medicine practice.

Auditing is an important and continuous process, and a valuable tool in assessing the impact of the transfusion committee's policies. Given this, we aim to continue regular and mandatory training not only for nurses (both focusing on new staff and drawing on the experience of more senior professionals) but also for doctors, in order to further improve the safety of our patients. Although a complete elimination of transfusion errors is a difficult goal to achieve, we hope to reduce the opportunities for errors occurring and will maintain a periodic evaluation of the impact of these measures.

The next step for the TMBBD is to engage and educate the Hospital's doctors in a similar education programme.

Our study has some limitations. It was not possible to compare the differences in the knowledge of the various subpopulations of nurses in terms of age, years of experience or the department in which they work, although this would have contributed valuable information to help us understand whether special attention and training should be given to any specific group of nurses. In addition, the reduction in the number of errors and near misses that was achieved through implementation of the education programme could have been skewed during analysis by under-reporting of events in both periods of the study.

Authorship contributions

All Authors belong to the Transfusion Medicine and Blood Bank Department of São João Hospital Center, Portugal, and participated either as trainers or members of the Transfusion Medicine and Blood Bank Department. Special thanks to Maria do Carmo Koch and Fernando Araújo for reviewing the paper.

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The Authors declare no conflicts of interest.

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